

ZOOLOGY.—*The land shells of the genus Amphidromus from the islands of the Palawan Passage.*¹ PAUL BARTSCH, U. S. National Museum.

My paper on *The Philippine Land Shells of the Genus Amphidromus*² has had the usual effect of stimulating collectors to transmit their shells to the United States National Museum for classification. In this instance we have been exceptionally fortunate in receiving a large sending of carefully labeled specimens collected by Mr. C. M. Weber, in the islands of Palawan Passage. These greatly needed shells throw a flood of light on the systematic problem of the complex that inhabits these islands and make it possible to give a positive statement about them. It will be remembered that I was forced to say in the paper above referred to: "I am quite perplexed by the following species [*Amphidromus quadrasii*] and feel at a loss as to the treatment that should be accorded to it."

Mr. Weber's material shows that on some of the islands off southern Palawan these mollusks present a most remarkable range of color variation and, what is more, show that similar types of coloration occur upon several islands. The present collection establishes beyond a doubt the fact that no matter how interesting they may be from a breeder's standpoint, systematically considered these color phases have no more significance than the *unicolor*, *unicincta*, *bicincta*, *tricincta*, and *quadricincta* forms of *Helicostyla ovoidea* which I have found in a single brood of that species.

The group breaks readily into two divisions. In the first group the tip is always white and the early whorls are flesh-colored, turning gradually to yellow which becomes intensified as the shell increases and is darkest immediately behind the aperture, or the yellow may be replaced by green. A very narrow light line marks the summit of the turns below which a deep-maroon band encircles the whorls; the base at the columellar border is also edged with this color, while the lip is always white. This is *Amphidromus quadrasii* Hidalgo. This species, so far, is known from three islands, Candaraman, Cosisigan, and Bekin.

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² Bull. 100, U. S. Nat. Mus., Vol. 1, pt. 1, pp. 1-47, pl. 1-22, 1917.

Measurements of a large series of specimens from these islands show that there is a decided difference in the size of the specimens obtained on the three islands. The difference is probably best expressed in table 1.

TABLE 1

LOCALITY	NUMBER MEASURED	NUMBER OF WHORLS	ALTITUDE	GREATER DIAMETER
Candaraman.....	17	6.87	35.91	17.76
Caxisigan.....	65	6.72	33.53	17.12
Bekin.....	73	6.42	30.50	15.95

These differences I consider sufficient to demand a trinomial designation. The specimens from Candaraman are *Amphidromus quadrasi quadrasi* Hidalgo, the type locality for this subspecies. Those from Caxisigan may be known as *Amphidromus quadrasi caxisiganensis* Bartsch³ and those from Bekin as *Amphidromus quadrasi ledyardi* Bartsch.⁴

The second group we may consider typified by *Amphidromus versicolor* Fulton. Specimens of this group always have the extreme tip dark brown; the rest of the turns may be white, pale yellow or wax yellow, or variously variegated; in the latter case the two or two and a half turns succeeding the dark tip are usually uniformly flesh-colored, while the ground color of those following may be white, yellow, green, or red, or sometimes several of these colors, one overlying the other, may be present; in each instance, if otherwise than white, the tint gradually becomes intensified toward the aperture. The whorls between the first two and the last may be unicolor or they may be marked by axial lines, bands, or forked flammulations of chestnut brown. The base may be unicolor or spirally banded with yellow, green, brown, or red. The columellar area may be white or edged with yellow, green, brown, or red. The lip may be white, pink, or purple, while the interior ranges from white through pearl gray, pink, pale purple, to spinel red. The general impression which one gains by looking at a tray of mixed specimens is a rainbow effect.

³ Type, Cat. No. 215603, U. S. National Museum.

⁴ Type, Cat. No. 215606, U. S. National Museum.

Amphidromus versicolor Fulton is now known from Balabac, Mantangule, Bancalan, and southern Palawan, all much larger islands than those occupied by *Amphidromus quadrasi* Hidalgo.

In spite of the great general variability of the color pattern, certain phases of coloration prevail on the separate islands which would enable one thoroughly familiar with these molusks to name with a fair degree of accuracy the island from which a specimen was derived. Measurements of a large series of specimens from the various islands give the results shown in table 2.

TABLE 2

LOCALITY	NUMBER MEASURED	NUMBER OF WHORLS	ALTITUDE	GREATER DIAMETER
Balabac.....	199	6.65	37.88	18.89
Bancalan.....	255	6.63	37.44	18.75
Mantangule.....	63	6.51	34.01	17.33
Palawan Passage.....	3	6.93	39.86	19.93
Palawan, Brooks Pt.....	25	6.77	38.26	19.66
Palawan, Mt. Landargung.....	2	6.80	38.60	20.60

The shell described by me⁵ from "Palawan Passage" as *Amphidromus quadrasi palawanensis* yield measurements that agree nearest with those of *Amphidromus versicolor everetti* which comes from southern Palawan. They also agree with this in having a remarkably uniform color pattern and dark coloration both outside and within, but they lack the obsolete peripheral angle characteristic of all the Palawan shells seen. It is unfortunate that we do not have a definite island locality for them.

The dark-colored race from the low lands of southern Palawan will have to be known as *Amphidromus versicolor everetti* Fulton, and it is more than possible that the shell described as *Amphidromus quadrasi solida* Fulton from Palawan will prove to be simply a color phase of this race. I have not seen specimens of it from Palawan. The forms I called *Amphidromus quadrasi solidus* in my paper from Balabac must now be placed with *Amphiarionus versicolor versicolor* Fulton. The main coloration of *Amphidromus versicolor everetti* Fulton is very similar to my *Amphidromus*

⁵ Bull. 100, U. S. Nat. Mus., Vol. 1, pt. 1, pp. 39-40, pl. I, fig. 15, pl. 20, figs. 1, 4, 6, 9. 1917.

versicolor palawanensis, but the presence of a peripheral angle separates it from that subspecies.

From Mt. Landargung, in the interior of southern Palawan, we have seen two specimens collected at an altitude of 2,500 feet which, while they agree in general coloration with *Amphidromus versicolor everetti*, are nevertheless much lighter in tone than that form, and the interior, instead of being purplish, is white. The edge of the lip is dark purple.

This mountain race deserves to be recognized by a trinomial name, and I will call it *Amphidromus versicolor monticolus*. The type⁶ had 6.7 whorls and measures: altitude, 40.3 mm., greater diameter, 21.2 mm.

The greatest range coloration is presented in the forms from Vancalan Island, which may be known as *Amphidromus versicolor higginsii* Bartsch.⁷ A selected series shows no less than twenty-eight types of coloring, which I shall describe briefly.

1. Tip dark, the ground color white, with a greenish suffusion which is most pronounced on the parietal callus.

2. Wax-yellow, a little lighter on the early whorls, with a greenish tint on the last; tip dark.

3. Midway in coloration between the last two but with an obsolete angle at the periphery.

4. Tip dark, the next white with a yellowish suffusion; last whorl gradually turning green; edge of the lip maroon.

5. Like the last. In addition, however, all but the first two and a half and the last one and a half turns, are marked by axial flammulations of chestnut brown.

6. Like no. 4, but with the early whorls wax-yellow, and the lip white.

7. Like the last, but the first three postnuclear turns show faint, light brown axial flammulations in addition.

8. Tip dark, the first two and a half turns flesh-colored; the two and a half succeeding these with flesh-colored ground upon which strong, axial, branching flammulations of chestnut brown are placed; the rest is wax-yellow turning greenish on the last turn. The last two and a half turns are encircled by a narrow zone of carmine at the suture, which color also surrounds the insertion of the columella.

9. Tip dark; all but the last four-fifths of the turns pale wax-yellow, the last portion marked by closely spaced dense axial streaks of varying

⁶ Cat. No. 218795, U. S. National Museum.

⁷ Type, Cat. No. 218420, U. S. National Museum.

shades of brown overlaid with a suffusion of pale green; lip maroon; umbilical area wax-yellow.

10. Like the above, but the dark coloration extends attenuatedly back over the last one and a quarter turns. The lip, also, is white.

11. Like no. 9, but with very pale yellow ground color. The space between the second and the last three-quarters of the last turn is marked by axial flammulations.

12. Like the above, excepting that the ground color and the lip are white. Columellar callus pale yellow and the solid color of the last portion of the shell extending over one and a quarter turns.

13. Tip dark; early whorls flesh-colored, those succeeding pinkish flesh-colored with obsolete axial flammulations of pale brown; last turn grenadine pink with a yellowish suffusion. Inside of aperture pale hermosa pink; edge of peristome dark purplish brown.

14. Tip dark; next two whorls flesh-colored, the two and a half succeeding flesh-colored with light chestnut brown axial flammulations; last turn wax-yellow; periphery angulated; base with two equally wide chestnut brown spiral bands of which one is immediately anterior to the periphery while the other is situated a little anterior to the middle of the base. These bands do not extend over the last half of the base. Peristome and interior white.

15. Like the last, but with the last turn deep wax-yellow gradually turning to green near the aperture. The two basal bands scarcely extend beyond the edge of the lip.

16. Like no. 13, but with a broad, wax-yellow spiral band whose posterior edge touches the posterior angle of the aperture. A second wax-yellow band marks the columellar area.

17. Like the last in coloration of the spire; base wax-yellow except the narrow band of grenadine pink immediately below the angulate periphery and a second one of the same color, which is situated on the center of the base, which evanesces before it reaches the middle of the last half turn.

18. Tip dark; the next two turns flesh-colored; all the rest except the last three-quarter turns of the last whorl flesh-colored with many axial, chestnut brown flammulations and a narrow subsutural wax-yellow zone. The last turn gradually darkens to olive green near the aperture. Aperture pale grayish blue within; peristome edged with blackish purple. A broad yellow band encircles the base at the posterior angle of the aperture and extends a little beyond its outer lip.

19. Like the last, but with the peristome white.

20. Similar to the last, but with the last whorl of much lighter color.

21. Similar to the last, but with the last whorl much lighter in color, greenish, purplish, and yellowish shades prevailing. The base, also, is wax-yellow and the lip is white with a purplish tint.

22. Tip dark; the next two turns flesh-colored; the rest at first with flesh-colored ground color which gradually gives way to yellowish, marked by many chestnut brown axial flammulations. On the last turn the axial color bands gradually become fused resulting in a dingy brown-

olive patch on the middle of the turn behind the aperture. The area near the summit of the whorls remains pale wax-yellow. Base with a narrow spiral chestnut brown band whose posterior border touches the posterior angle of the aperture; this is succeeded by a broad, yellow spiral zone, and this in turn by an equally wide spiral brown band, while the columellar area is a greenish and pinkish yellow. Lip white.

23. Like the last, but with the subperipheral spiral band double.

24. Like no. 22, but with the base dark chestnut-brown and a spiral mid-basal wax-yellow band, the columella area wax-yellow.

25. Tip dark; the two first turns flesh-colored; the ground color of the rest pale wax-yellow excepting the last turn, which is wax-yellow. All except the first two, and the last half of the last turn are marked by axial chestnut-colored flammulations. The last turn has fine spiral lines of chestnut brown. Base with a subperipheral and median band of dark chestnut brown, the rest wax-yellow excepting a pinkish line at the insertion of the columella. This line is also carried around the inner lip of the aperture, the inside of which is pale pinkish white.

26. Tip dark; the first two whorls flesh-colored; the ground color of the succeeding turns flesh-colored, this on the last whorl slowly giving way to pale yellow. All but the first two whorls marked by chestnut-brown axial flammulations, which, on the last turn, do not terminate at the periphery but extend over the base. These axial markings become condensed immediately behind the lip and render this portion almost unicolor. The inside of the aperture shows the dark color bands of the exterior. The peristome is white, but the inner edge of the lip is marked by purplish dark chestnut-brown bands.

27. Similar to the last, but of much more yellowish color, and with the axial flammulations much broader. These axial broad bands form an angle as they pass over the periphery. The insertion of the columella is encircled by a dark chestnut band.

28. Similar to the last but with the base largely dark excepting a broad pinkish band a little anterior to the periphery. This band becomes evanescent before it encircles half of the last turn.

The shells from Mantangule Island, which may be called *Amphidromus versicolor weberi*,⁸ are by far the most brilliantly colored of all the known races of *Amphidromus versicolor*. However, we have here a much more uniform color pattern than in the specimens in the races from Balabac and Bancalan. All the specimens have a dark tip which is succeeded by two or more flesh-colored turns. The ground color of the succeeding turns may be flesh-colored, tinged with yellow or wax-yellow. In the one type of coloration no axial flammulations of chestnut brown are present on these whorls, while in the other they are strongly marked.

⁸ Type, Cat. No. 218422, U. S. National Museum.

The last turn is usually light near the summit, then girdled with a broad, dark area which is of the same color as the dark area of the base but is separated from this by a narrow light zone at the periphery. The dark coloration of the last turn may be green or light coral-red or the latter overlaid with green. The base may be unicolor, i. e., white, yellow, green, red, or brown, or it may have one or two bands of yellow, brown, or red. The portion of the last whorl adjoining the columellar callus is usually coral-red. The interior is white, bluish, or pinkish, the peristome white or edged with purplish brown.

The table on page 363 gives additional data as to number of whorls and shell measurements.

The specimens which I have seen from Balabac Island show a lesser variability in coloration than those from Bancalan, to which they bear the greatest resemblance. There is here a much greater tendency to spiral banding of the base than in the shells from any of the other islands. All of the specimens of *Amphidromus versicolor weberi* examined have a white peristome but in *Amphidromus versicolor higginsi* this is frequently dark. In measurements they agree best with the shells from Bancalan Island, i. e., *Amphidromus versicolor higginsi*.

The present sending by no means completes the survey of the Palawan Passage region, for as yet we know nothing of the *Amphidromus* inhabitants of the three large islands Bugsuk, Pandanan, and Ramos, nor do we know anything about the group on the lesser islands of Apo, Bowne, Canimeran, Patongong, Gabung, Byan, Canabungan, Secam, Malinsono, Sanz, and Paz. Then, too, the many islands off the north coast of Borneo should contribute a large amount of information that should tell us something of the derivation of the forms in our domain which are undoubtedly of Bornean stock.